

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A vehicular gas emission analyzer assembly for a vehicle, comprising:  
a gas analyzer system adapted to determine at least one emission parameter from an internal combustion engine, said at least one emission parameter chosen from (i) concentration of at least one exhaust gas, (ii) mass of at least one exhaust gas, (iii) concentration of exhaust particulate matter; and (iv) mass of exhaust particulate matter; and  
a housing for said gas analyzer system, said housing being substantially moisture impervious in order to be resistant to environmental elements.
2. The analyzer assembly in claim 1 wherein said housing is adapted to mounting at an external portion of a vehicle body.
3. The analyzer assembly in claim 1 wherein said housing has a length and a width, said length and width of said housing defining an aspect ratio, wherein said aspect ratio is greater than or equal to two (2).
4. The analyzer assembly in claim 1 including a communication channel for communicating data from said at least one gas detector to a system outside of said housing.
5. The analyzer assembly in claim 4 wherein said communication channel is a wireless communication channel.
6. The analyzer assembly in claim 1 including vibration dampers to reduce vibration of components defining said gas analyzer system.
7. The analyzer assembly in claim 1 wherein said gas analyzer system comprises one of a gasoline engine analyzer and a diesel engine analyzer.
8. The analyzer assembly in claim 1 wherein said gas analyzer system includes at least one gas analyzer chosen from (i) a non-dispersive infrared analyzer, (ii) a

- Fourier transform infrared analyzer, (iii) an ultraviolet analyzer, (iv) a mass spectrometer, (v) a mass analyzer comprising an electromechanical oscillator holding a substrate onto which particulate matter can accumulate, and (vi) a mass analyzer comprising a filter substrate onto which particulate matter can accumulate.
9. A vehicular gas emission analyzer assembly for a vehicle, comprising:  
a gas analyzer system adapted to measure at least one emission parameter from an internal combustion engine, said at least one emission parameter chosen from (i) concentration of at least one exhaust gas, (ii) mass of at least one exhaust gas, (iii) concentration of exhaust particulate matter; and (iv) mass of exhaust particulate matter; and  
a housing for said gas analyzer system, said housing having a length and a width, a ratio of said length to said width defining an aspect ratio of said housing, wherein said aspect ratio of said housing is greater than or equal to two (2).
10. The analyzer assembly in claim 9 wherein said housing is substantially in the form of a cylinder.
11. The analyzer assembly in claim 10 wherein said housing is substantially in the form a circular cylinder.
12. The analyzer assembly in claim 9 including an interface for retrieving measured parameters of a vehicle engine, wherein said measured parameters can be combined with an output of said gas analyzer system.
13. The analyzer assembly in claim 12 wherein said measured parameters are in a serial data stream.
14. The analyzer assembly in claim 9 including means for measuring flow rate of the emissions of the vehicle.
15. The analyzer assembly in claim 14 wherein said means for measuring flow rate comprises a flow meter.

16. The analyzer assembly in claim 9 wherein said housing has a generally aerodynamic shape.

17. The analyzer assembly in claim 9 wherein said housing is substantially moisture impervious in order to be resistant to environmental elements.

18. The analyzer assembly in claim 9 wherein said gas analyzer system includes at least one gas analyzer chosen from (i) a non-dispersive infrared analyzer, (ii) a Fourier transform infrared analyzer, (iii) an ultraviolet analyzer, (iv) a mass spectrometer, (v) a mass analyzer comprising an electromechanical oscillator holding a substrate onto which particulate matter can accumulate, and (vi) a mass analyzer comprising a filter substrate onto which particulate matter can accumulate.

19. A vehicular gas emission analyzer assembly for a vehicle, comprising:  
a gas analyzer system adapted to measure at least one emission parameter from an internal combustion engine, said at least one emission parameter chosen from (i) concentration of at least one exhaust gas, (ii) mass of at least one exhaust gas, (iii)  
5 concentration of exhaust particulate matter; and (iv) mass of exhaust particulate matter; and

a housing for said gas analyzer system, wherein said housing defines multiple internal zones, each of said zones being at a different temperature.

20. The analyzer assembly in claim 19 for calculating the mass of said at least one exhaust gas in grams per each mile driven by the vehicle.

21. The analyzer assembly in claim 19 wherein each of said internal zones has a substantially consistent temperature in a direction laterally of the housing and wherein said zones vary in temperature from each other in a direction longitudinally of the housing.

22. The analyzer assembly in claim 19 including a volumetric flow meter adapted to be attached to an exhaust tailpipe of the vehicle and wherein said mass is determined by resolving said measured concentration and volumetric exhaust gas flow measured by said volumetric flow meter.

23. The analyzer assembly in claim 19 including a probe adapted to withdraw exhaust from a vehicle tailpipe.
24. The analyzer assembly in claim 23 including a heated line connecting said probe with said housing.
25. The analyzer assembly in claim 19 wherein said gas analyzer system operates substantially uninfluenced by supplemental cooling.
26. The analyzer assembly in claim 19 wherein said gas analyzer system operates at a temperature that is at or above the dew point of the vehicle exhaust gas.
27. The analyzer assembly in claim 26 wherein said gas analyzer system further includes calculating means for compensating said emission parameter for the effect of humidity present in said exhaust gas.
28. The analyzer assembly in claim 26 wherein said gas analyzer includes a heated device for measuring concentration of hydrocarbon, said heated device at a temperature sufficiently high to reduce the deposit of hydrocarbon materials on said heated device.
29. The analyzer assembly in claim 19 wherein said gas analyzer includes a heated device for measuring concentration of hydrocarbon, said heated device at a temperature sufficiently high to reduce the deposit of hydrocarbon materials on said heated device.
30. The analyzer assembly in claim 29 wherein said heated device comprises an infrared-based gas concentration reader.
31. The analyzer assembly in claim 29 wherein said heated device comprises a flame ionization device.

32. The analyzer assembly in claim 29 wherein said device for measuring concentration of hydrocarbon is heated to a temperature at or above 60 degrees centigrade.
33. The analyzer assembly in claim 32 wherein said gas analyzer is adapted to spark-ignition engines.
34. The analyzer assembly in claim 31 wherein said device for measuring concentration of hydrocarbon is heated to a temperature at or above 175 degrees centigrade.
35. The analyzer assembly in claim 34 wherein said gas analyzer is adapted to compression-ignition engines.
36. The analyzer assembly in claim 19 wherein said gas analyzer includes at least one device for measuring  $\text{NO}_x$  which operates substantially without supplemental cooling of said exhaust gas.
37. The analyzer assembly in claim 36 wherein said device for measuring  $\text{NO}_x$  utilizes ultraviolet detection techniques.
38. The analyzer assembly in claim 36 wherein said device for measuring  $\text{NO}_x$  utilizes a heated zirconia detector.
39. The analyzer assembly in claim 36 wherein said device for measuring  $\text{NO}_x$  utilizes an electrochemical cell.
40. The analyzer assembly in claim 19 wherein said gas analyzer includes at least one device for measuring  $\text{NO}_x$  which utilizes ultraviolet detection techniques.
41. The analyzer assembly in claim 40 wherein said gas analyzer includes an ultraviolet discharge lamp.

42. The analyzer assembly in claim 19 wherein said gas analyzer includes at least one gas detector to measure the concentration of at least one gas emitted from the engine, at least one pump to draw gas from the engine and at least one gas channel linking between said at least one detector and said at least one pump.

43. The analyzer assembly in claim 19 wherein said gas analyzer system includes at least one gas analyzer chosen from (i) a non-dispersive infrared analyzer, (ii) a Fourier transform infrared analyzer, (iii) an ultraviolet analyzer, (iv) a mass spectrometer, (v) a mass analyzer comprising an electromechanical oscillator holding  
5 a substrate onto which particulate matter can accumulate, and (vi) a mass analyzer comprising a filter substrate onto which particulate matter can accumulate.

44. A vehicular gas emission analyzer assembly for a vehicle, comprising:  
a gas analyzer system adapted to determine at least one emission parameter from an internal combustion engine, said at least one emission parameter chosen from (i) concentration of at least one exhaust gas, (ii) mass of at least one exhaust gas, (iii)  
5 concentration of exhaust particulate matter; and (iv) mass of exhaust particulate matter; and  
a housing for said gas analyzer system, including vibration dampening means for reducing vibration of said gas analyzer system.

45. The analyzer assembly in claim 44 wherein said vibration dampening means comprises shock-mounts for at least one component making up said gas analyzer system.

46. The analyzer assembly in claim 44 wherein said vibration dampening means comprises shock-mounts for said housing.

47. The analyzer assembly in claim 44 including another housing supporting said housing, wherein said dampening means comprises spacers between said housing and said another housing.

48. The analyzer assembly in claim 47 wherein said dampening means further comprises shock-mounts for said another housing.

49. The analyzer assembly in claim 44 wherein said gas analyzer system includes at least one gas analyzer chosen from (i) a non-dispersive infrared analyzer, (ii) a Fourier transform infrared analyzer, (iii) an ultraviolet analyzer, (iv) a mass spectrometer, (v) a mass analyzer comprising an electromechanical oscillator holding  
5 a substrate onto which particulate matter can accumulate, and (vi) a mass analyzer comprising a filter substrate onto which particulate matter can accumulate.

50. A vehicular gas emission analyzer assembly for a vehicle, comprising:  
a gas analyzer system adapted to measure at least one emission parameter from an internal combustion engine, said at least one emission parameter being  
chosen from (i) concentration of at least one exhaust gas, (ii) mass of at least one  
5 exhaust gas, (iii) concentration of exhaust particulate matter; and (iv) mass of exhaust particulate matter;

a housing for said gas analyzer system;

said housing being substantially moisture impervious in order to be resistant to environmental elements;

10 said housing having a length and a width, a ratio of said length to said width defining an aspect ratio of said housing, wherein said aspect ratio of said housing is greater than or equal to two (2);

said housing defining multiple internal zones, each of said zones being at a different temperature; and

15 vibration dampening means for reducing vibration of said gas analyzer system.

51. A hydrocarbon gas analyzer for analyzing at least the concentration of hydrocarbon, present in mixture of gases in a vehicle emission, comprising:

a sample cell;

5 a source and a sensor for measuring concentration of hydrocarbon gas in said cell; and

a heater adapted to heating said cell to a sufficiently high temperature to reduce deposition of hydrocarbon molecules present in the sample gas upon inner surfaces of said sample cell, thereby decreasing loss of hydrocarbon gas and increasing accuracy of measurement.

52. A method for measuring the concentration of hydrocarbon gas present in a mixture of gases in a vehicle emission using a spectral-absorption-based device, comprising:

- transferring the sample in a heated channel maintained at a sufficiently high
- 5 temperature to reduce deposition of hydrocarbon molecules present in the sample upon the inner surfaces of said channel; and
- measuring concentration of at least one component of the sample while maintaining the device and the sample at sufficiently high temperatures to reduce deposition of said hydrocarbon molecules present in the sample upon the inner
- 10 surfaces of the device, thereby decreasing the loss of the hydrocarbon gas and consequently increasing the accuracy of the measurement.

53. A gas analyzer for analyzing at least the concentration of a gas chosen from a nitrogen-based gas, a hydrocarbon-based gas and a sulfur-based gas, comprising:

- a sample chamber;
- at least one ultraviolet source emitting radiation through said sample chamber,
- 5 said at least one ultraviolet source includes a discharge lamp having a discrete emission line at an absorption frequency for a particular nitrogen-based gas;
- at least one ultraviolet sensor sensing said radiation; and
- a control converting an output of said sensor to a value of a gas concentration
- in a sample gas in said sample chamber.

54. A method of detecting at least the concentration of a gas chosen from nitrogen-based gas, a hydrocarbon-based gas and a sulfur-based gas present in a sample, comprising:

- enclosing in a container a mixture of gases comprising at least nitrogen, said
- 5 container comprising at least one section substantially transparent to ultraviolet radiation energy;
- providing input energy to said mixture of gases causing discharge of ultraviolet radiation energy;
- directing said ultraviolet radiation energy emitted from said transparent
- 10 section through the sample;
- measuring the portion of said ultraviolet radiation energy not absorbed by the gas in the sample; and



calculating the concentration of the gas in the sample from its absorption of said ultraviolet energy.

55. A real-time engine emission processing system for an internal combustion engine having an exhaust, comprising:

means for determining fuel consumption rate of the engine;

means for determining concentration of at least one gas emitted from the

5 exhaust of the engine; and

calculating means for calculating mass flow rate of said at least one gas from said fuel consumption rate and said concentration of said at least one gas.

56. A device for measuring the hydrocarbon contents in a sample of gas emitted from an engine, comprising:

flame ionization detector comprising a burner fed by at least hydrogen and an electrometer sensing charge of ionized molecules resulting from combustion of the  
5 hydrocarbons in the sample by the flame of said burner; and

hydrogen storage means providing hydrogen to said burner and comprising at least one metal hydride alloy contained in a storage container, said metal alloy capable of absorbing and releasing hydrogen.

57. A real-time engine emission reporting system, comprising:

a pollutant concentration detector for detecting concentration of at least one pollutant within an engine exhaust;

5 a gas analyzer for measuring the concentration of at least one carbon-based gas within the exhaust gas;

fuel flow means for determining the flow rate of the fuel to the engine; and

calculating means for calculating mass flow of said pollutant from said concentration of said pollutant, said concentration of the at least one carbon-based gas, and said flow rate of the fuel.

58. A real-time, on road vehicle emission analyzer, comprising:

means for diluting exhaust gas from an engine of the vehicle; and

a gas analyzer system adapted to receive diluted exhaust gas from said means for diluting exhaust gas and determine at least one emission parameter from the

- 5 diluted exhaust gas, said at least one emission parameter chosen from (i) concentration of at least one exhaust gas, (ii) mass of at least one exhaust gas, (iii) concentration of exhaust particulate matter; and (iv) mass of exhaust particulate matter.